Amendments to the Claims

Please amend the claims without prejudice. The listing of claims will replace all prior versions, and listings, of claims in the application:
Listing of the Claims

CLAIMS

1- (Currently Amended) A method for determining a velocity of ultrasound propagation in a drilling fluid flowing in a mud channel within a borehole of a downhole environment, comprising:

disposing a first ultrasound transducer (37) ~~adjacent to~~ across the mud channel from a second ultrasound transducer (39) such that a front face (37f) of the first transducer (37) is offset from a front face (39f) of the second ultrasound transducer (39) by a predetermined radial offset distance (ΔDf), wherein the transducers are separated from the mud channel by a thin interface for protecting the transducers from the drilling fluid flowing in the mud channel while permitting the ultrasound propagation there through;

emitting an ultrasound pulse into the drilling fluid in a borehole using the first ultrasound transducer(37);

detecting the ultrasound pulse after the ultrasound pulse has travelled through the drilling fluid a distance (d);

determining a travel time (t) for the ultrasound pulse to travel the distance (d) through the drilling fluid in the borehole between the first and second transducers; and

determining the velocity of ultrasound propagation in the drilling fluid from the distance (d) and the travel time (t).

2- (Original) The method according to claim 1, wherein the detecting the ultrasound pulse is performed with the first ultrasound transducer (37).

3- (Original) The method according to claim 1, wherein the detecting the ultrasound pulse is performed with the second ultrasound transducer (39).

4- (Original) The method according to claim 1, wherein the detecting the ultrasound pulse is performed with both the first and second ultrasound transducer.

5- (Original) The method according to claim 4, further comprising determining a borehole diameter (D_{bh}) using the predetermined offset distance (ΔDf) and a difference in travel times ($T_2 - T_1$) for the ultrasound pulse to be detected by the first ultrasound transducer (37) and the second ultrasound transducer (39).

6- (Original) The method according to claim 1, wherein the detecting the ultrasound pulse is performed by the first ultrasound transducer (37), and wherein the method further comprises:
emitting a second ultrasound pulse into the drilling fluid in the borehole using the second ultrasound transducer (39); and
detecting the second ultrasound pulse after the second ultrasound pulse has traveled through the drilling fluid a distance ($d + 2\Delta D_f$) using the second ultrasound transducer (39).

7- (Original) The method according to claim 6, wherein the ultrasound pulse and the second ultrasound pulse are emitted simultaneously.

8- (Previously presented) The method according to claim 1, wherein the drilling fluid is located in an annulus between a tool and a borehole wall.

9- (Currently amended) An apparatus for determining a velocity of ultrasound propagation in a drilling fluid within a borehole of a downhole environment, comprising:

a first ultrasound transducer (37) disposed on a tool;

a second ultrasound transducer (39) ~~adjacent to~~ across the mud channel from a second ultrasound transducer (39) such that a front face (37f) of the first transducer (37) is offset from a front face (39f) of the second ultrasound transducer (39) by a predetermined radial offset distance (ΔDf), wherein the transducers are separated from the mud channel by a thin interface for protecting the transducers from the drilling fluid flowing in the mud channel while permitting the ultrasound propagation there through; and

a circuitry (82) for controlling a timing of an ultrasound pulse transmitted by the first ultrasound transducer (37) and for measuring a time lapse between ultrasound transmission and detection after the ultrasound pulse has traveled a distance (d) through the drilling fluid in the borehole between the first and second transducers.

10- (Original) The apparatus according to claim 9, wherein the first ultrasound transducer (37) and the second ultrasound transducer (39) are disposed on an outside surface of the tool.

11 (Currently amended) Apparatus for determining a velocity of ultrasound propagation in drilling mud, the apparatus comprising:

a tool chassis located within a borehole, the chassis is shaped to define a mud channel therein for providing a path through which the drilling mud is pumped into the borehole;

a first and a second ultrasonic transducer located across the mud channel and facing each other spaced at a distance (d), wherein the transducers are separated from the mud channel by a thin interface for protecting the transducers from the drilling fluid flowing in the mud channel while permitting the ultrasound propagation there through;

circuitry for controlling the first and the second transducers to measure a time lapse between ultrasound transmission and detection after an ultrasound pulse has traveled the distance (d) across the drilling mud, and is thereby able to determine the velocity of ultrasound propagation in the drilling mud.